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# Comparison of Laparoscopic and Percutaneous Cryoablation of Renal Tumors: A Cost Analysis

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## Abstract

Cryoablation of renal masses is an evolving *in situ* ablative technique for the management of localized renal masses and can be performed in a laparoscopic or percutaneous manner. Its usefulness is increasing and correlates with the increasing frequency of incidentally diagnosed renal lesions. At present, this technique has been applied to patients deemed to be poor surgical candidates for extirpative therapy or those with a strong desire to avoid surgery, at least until long-term data become available to fully evaluate its cancer-control effectiveness. In addition, as costs become an ever more critical factor in healthcare, the costs of various management options for clinically localized kidney cancer will become as important as clinical outcomes in deciding appropriate treatment. We compare laparoscopic and percutaneous renal cryoablation from a cost perspective. Our findings indicate that percutaneous renal cryoablation may have distinct cost advantages over its laparoscopic counterpart. It remains to be seen whether these differences will translate into an overall increase in reliance on the percutaneous approach for renal cryoablation.

## Introduction

NEPHRON-SPARING SURGERY (NSS) is becoming the new standard of care for the management of clinically localized renal cell carcinoma.<sup>1</sup> To date, extirpative as well as ablative therapies in the form of radiofrequency ablation and cryoablation have been used, with various advantages and disadvantages to each. Gill and associates<sup>2</sup> have recently shown that patients undergoing laparoscopic cryoablation (LCA) for small renal masses have a 98% cancer-specific overall survival at 3 years, with only two cases of persistent cancer at postoperative biopsy. With such encouraging early reports, cryoablation will increasingly be used for the management of renal lesions, with the decision to use the laparoscopic or percutaneous approach based largely on the location of the tumor and the patient comorbidity profile.

From a socioeconomic standpoint, these two approaches differ significantly. Various issues have limited previous attempts at direct cost comparison. These include differences in billing codes at different institutions, regional insurance compensation differences, technical differences in the number of cryoprobes used by surgeons and interventional radiologists as well as other disposable equipment, and differences in the postoperative radiologic follow-up regimen that can contribute significant costs to overall management.

We compare overall and categorical costs associated with LCA and percutaneous cryoablation (PCA) at Washington University Medical Center.

## Materials and Methods

From January 1, 2004, to August 31, 2006, a total of 23 LCA procedures were performed at Barnes Jewish hospital by various surgeons (SBB, RSF, and RV). In the same time interval, a total of 13 PCA procedures were also performed by one radiologist (DB). Charges incurred were determined to calculate total, anesthesia, operating room, hospital admission, and surgeon charges.

### *Percutaneous renal cryoablation*

A total of 13 procedures were performed percutaneously by a single interventional radiologist (DB) under regional anesthesia. Costs incurred during these procedures included radiologist fees, radiology department fees (CT), disposables, and hospital admission costs (if applicable). Two of 13 patients were admitted to the hospital postoperatively, and those costs were included in our figures. Generally, our indications for PCA include small renal masses (generally less than 3 cm), advanced age, presence of comorbid conditions precluding other procedures that require general anesthesia,

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and posterior tumors amenable to percutaneous access on preoperative imaging. Patient preference is also considered after patients are thoroughly informed of their options and of long-term risks and benefits of each procedure.

#### Laparoscopic renal cryoablation

LCA is performed in a transabdominal or retroperitoneal approach, depending on the location of the mass. Indications include tumor size less than 4 cm, and the patient amenable to surgical intervention. Length of postoperative admission averages 3.3 days (median 2 d). Costs incurred for these procedures include admission, operating room, disposables, surgeon, anesthesia, and pathology laboratory fees.

#### Results

LCA average total costs were calculated to be \$32,900, with a median total cost of \$29,617 (Table 1). These totals include costs for the laparoscopic procedure, admission costs, and physician fees. The average cost billed for PCA is \$9,240, with a median total cost of \$6,861. An attempt was also made by the authors to determine the actual collection rate, given that institutions may charge different rates for the same procedure but collection rates tend to be more standardized. Only Medicare collection information was available to us, and the Medicare collection rate was used for all data. Using these figures, LCA collects \$14,346 and PCA \$4,134.

#### Discussion

LCA and PCA are different procedures with a similar end point: Cryoablation of the renal tumor. In spite of these similarities; there are important present differences. The laparoscopic approach obviously affords live visual and ultrasonographic feedback of the progress of the ice ball, is able to target lesions not amenable to the percutaneous approach, enables the surgeon to obtain a core biopsy specimen, and allows the surgeon to determine early if probe site bleeding needs to be addressed. In addition, nearby vital structures can be more easily avoided under vision.

Conversely, PCA can be performed on an outpatient basis and is associated with less postoperative pain. With the ability to perform live CT fluoroscopy, real-time assessment of ice ball progression to ensure total lesion ablation is now possible. The indications for each of these procedures continue to evolve with their respective technologies and operator expertise.

From a socioeconomic standpoint, these procedures are strikingly different. Given the current medical climate of promotion of outpatient medical care, PCA eliminates many hospital charges, most notably admission and operating room costs.

Previous investigators have demonstrated a cost advantage for laparoscopic renal surgery over its open counterpart, lending further support for implementing laparoscopic renal surgery as standard of care for most renal lesions today.<sup>4</sup> In addition, current socioeconomic pressures from third-party payers steer our surgical algorithms for management of clinically localized renal cell lesions, as long as cancer control is not jeopardized.

Our analysis reveals striking cost differences between LCA and PCA. At present, it is unclear what percentage of patients undergoing LCA or PCA experience failure and go on to extirpative therapy. This may change the overall costs of these procedures and will need to be analyzed in future series.

Link and colleagues<sup>3</sup> recently published their analysis of the cost differences between laparoscopic and percutaneous approaches to nephron-sparing procedures. They compared open partial nephrectomy, laparoscopic partial nephrectomy, LCA, and PCA and found that PCA was 2.2 to 2.7 times less costly than the other options, with savings of about \$5000 per patient. Novel to their approach is the use of detailed computer models to standardize patient costs based on historic data from their institution. Comparing our data, PCA at Washington University costs \$4776 (excluding two patient admissions) compared with \$3109 in their analysis. Extra cryoprobes used account for the difference between the values. Figures for LCA could not be compared, given their

TABLE 1. CATEGORICAL BREAKDOWN OF CHARGES INCURRED FOR BOTH LAPAROSCOPIC AND PERCUTANEOUS RENAL CRYOABLATION AT WASHINGTON UNIVERSITY MEDICAL CENTER<sup>a</sup>

	Adm days	Lap fees	Anesth fees	US fees	Path fees	OR charges	Radiology fees	Hospital fees	Cryoprobes used	Total avg (median)
LCA	3.3 (2)	\$3415 (\$3060)	\$2790 (\$2630)	\$317 (\$206)	\$286 (\$280)	\$12,047 (\$11,560)	N/A	\$26,085 (\$23,473)	2.45 (3)	\$32,900 (\$29,617)
PCA	0.3 (0)	N/A	N/A	N/A	N/A	N/A	\$527 (615)	\$6838 (\$4759)	4.2 (4)	\$9240 (\$6861)
		Category		Percent collected		Adjusted percentage <sup>b</sup>				
		Radiology		0.71		0.125				
		Surgical fees		0.37		0.81				
		Pathology		0.48		0.05				
		Hospital charges		0.55		0.01				

<sup>a</sup>Average values are provided (median values).

<sup>b</sup>Based on percent collected and overall percent of costs obtained from Medicare reimbursement rates.

Adm = admission days; Lap fees = laparoscopic surgical fees; Anesth fees = anesthesiology fees; US fees = ultrasound operator fee; path fees = pathology laboratory fees; OR charges = total operating room charges. Hospital fees include radiology fees, OR charges (for LCA), path fees, US fees, anesth fees, lap fees, in addition to admission charges, if patient was admitted.

use of operating room time, which was not available in our analysis.

With an annual incidence of approximately 30,000 cases per year (and many amenable to NSS), trends in management can translate into wide cost differences.

### Conclusion

LCA and PCA are being increasingly used for management of clinically localized renal lesions. Their indications are evolving with their respective technologies and operator expertise. We report a significant current cost advantage for the percutaneous approach. Given that current indications for these procedures are different (i.e., location of tumor, patient comorbidity profile), this may confer a future advantage for the percutaneous approach. In addition, it is not our aim to promote one of these approaches; rather, we simply report of differences in costs. One would have to consider the effectiveness of the two techniques in tumor ablation as multiple attempts for ablating the same tumor would change these results dramatically. That information is not currently available and would have to be updated in future reports.

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### Abbreviations Used

CT = computed tomography  
LCA = laparoscopic cryoablation  
NSS = nephron-sparing surgery  
PCA = percutaneous cryoablation

